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G84-723 Maximizing the Use of Farm Strip Plots

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Maximizing the Use of Farm Strip Plots

Strip plots are an effective means of comparing soil and crop management practices. Guidelines are given for establishing strip plots and evaluating the results.

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Farmers, extension and industry personnel, and researchers have a common interest in strip plots set out on farm fields to study various soil and crop management practices. Strip plots or tests are usually designed to compare differences between tillage methods, herbicide treatments, varieties, fertilizer sources or rates, methods of chemical application, and many other crop production inputs.

Strip tests established in farmer fields could satisfy wider interests, and conceivably yield more useful information, if the planners ensure that several important aspects have been considered. The following are guidelines for establishing strip plots and evaluating the results. Depending on the treatments or management practices compared, all or some of these guidelines should be considered.

Planning

The purpose or objective of the farm strip plot comparison must be clearly defined in advance of any

actual field work. For example, in determining the effect of tillage management, yield and other crop growth characteristics under conventional, minimum and zero tillage systems might be compared. A study of wheat varieties might compare semidwarf versus tall wheat varieties while keeping all other management inputs constant. Once your objective is expressed, do not change treatments unless field conditions dictate that changes should be made.

Treatments

Design treatments broadly enough to represent a specific practice or principle, and avoid small details. For instance, a producer might wish to compare deep placement of fertilizers versus broadcast applications. If this is the main objective, different fertilizer rates should not be included as treatments. It is very important that production inputs other than the treatments remain constant. If management inputs are changed between treatments, the results may be biased by those differences.

Validity of Results

Researchers insist that differences observed between treatments be 'real' and not simply the result of chance. Replication of treatments is used for this purpose in research experiments, but farmers may not be willing to replicate treatments in a strip plot project. Fortunately, replication can be achieved if a number of farms are included in the strip plot program, with the same treatments applied to all farms. Thus, each farm is a 'replicate'. For example, four treatments applied on ten farms provides an experiment with four treatments and ten replications. An estimate of experimental error can then be calculated and 'real' treatment differences determined.

With large plots normally associated with strip testing, variability within a replicate is often a serious problem. If a field has extreme variability, reduce the length of the test treatment to minimize the variability, or select another, more uniform, field. The optimum number of treatments is 2 to 5--more than 5 treatments increase variability and reduce the chance of detecting 'real' differences.

A second concern in the validity of the results is avoiding bias by placing a favorite treatment on a favorite block of land. This concern can be satisfied, with little if any inconvenience, by randomly allocating treatment positions in the field by some independent means (e.g. drawing numbers from a dish). Randomization of treatments within a field is an extremely important factor contributing to the final reliability of the results.

The concepts of replication and randomization are important considerations in establishing strip tests. The whole approach simply involves advanced planning and will not likely require extra work for the producer. Contact research and extension personnel for assistance.

Crop History

If known, record crop history for at least the last 3 to 5 years. Note previous crops and crop rotations practiced, and fertility programs used. Old soil test reports can be useful sources for this information. Also indicate any differences in primary tillage operations. If crop history differences exist between treatment areas, locate the strip test on a field with a similar management history.

Plot Size

Plot size will most likely be determined by field length and practicality of carrying out any special treatment over a large area. Limit the strip plot length so that each of the treatments can be

accommodated within a reasonably uniform tract of land (see the next section). Strip plot width can be determined by the width of the equipment used to apply the treatments (e.g. planter, sprayer, etc.). It is recommended that strips be twice the width of the equipment used.

Organizing Field Plots

Since there will be at least two treatments in a strip test field, a new or controversial treatment and a conventional *standard* to compare the new treatment against, how should the field be divided? The principle concern is the assurance that both treatments have equal opportunities to perform their best. For this, make a map of field variability, including drainage, texture, soil depth, topography, weed infestations, and bordering influences such as trees, runoff from neighboring fields, lack of fencing from animals, and other factors. If the field is completely uniform, simply arrange treatments so that each is exposed where visiting groups can view them. If the field has two or more different soil types or conditions, each extending across one axis, arrange the plot borders to run at right angles to these boundaries (*Figure 1*). If the field has one or more corners with different soil conditions or types, plots can be run through these; however, limit observations and harvest to a uniform portion of the field (*Figure 2*). Provide a sketch of the field showing visual soil variability, tree lines, tile lines (if applicable), topography or areas of slope, plot location within the field, and intended and actual harvest locations.

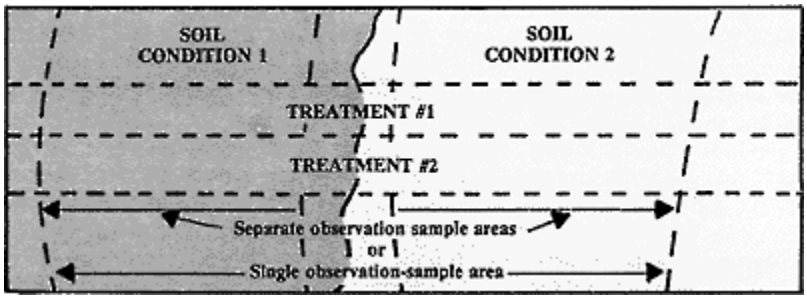

Figure 1. Example of field with two soil types or conditions.

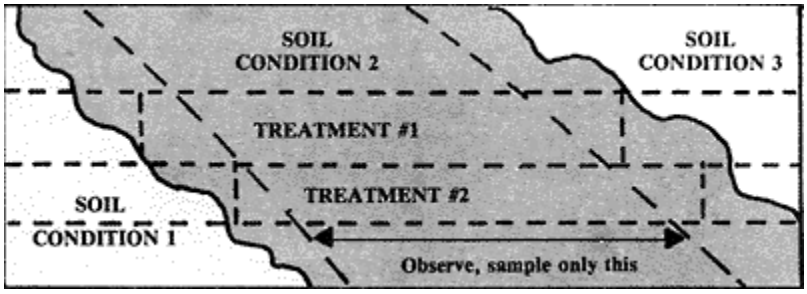

Figure 2. Example of field with three soil types of conditions.

Soil Tests

Separate soil samples from each treatment area are not required. However, sample the soils from the intended harvest area and send the composite sample to a reputable laboratory for analysis. Unless fertilizer rates are the treatments, compare the laboratory fertilizer recommendations with known crop responses to added nutrients to determine the appropriate fertilizer rates.

Planting

Conditions at planting are critical to the results and interpretation of strip plots involving crop growth. Record preplant (fall or spring) tillage practices used and the extent of residue cover from the previous crop. At planting, record the seeding rate, row spacing, hybrid, planting depth, soil moisture content, and surface conditions. List the sources and rates of fertilizers and pesticides used, and the methods of application. Also indicate equipment specifications and any other production input used at the time of planting. Again, any differences between treatment areas will bias the results and, therefore, only uniform field areas should be used.

Weather

General observation of the growing season weather conditions is all that is required. Place a simple rain gauge at the test site. After each storm, record the rainfall with the date and empty the rain gauge. Note rainfall effects on soil erosion. If drought conditions persist, note the difference in plant growth or response between treatments as influenced by these conditions. For example, corn leaves will curl and/or turn pale green under drought stress. Note any differences between treatments in this curling effect.

Insects, Weeds and Disease

Simple observations on the insects and diseases present, date of infestation, and extent of damage are sufficient. Similar observations for persistent weeds should also be recorded. Again, note differences between treatments, if any, due to the pests. If herbicide treatments are being compared, more detailed data should be taken to evaluate the differences between treatments.

Growth

Farmers and extension or industry persons should observe and record various growth characteristics of the crop from germination to harvest. The following observation points are recommended:

1. Date of emergence.
2. Extent of tillering (small grains).
3. Height at 4- to 8-leaf stage (coarse grains and legumes).
4. Any deficiency symptoms (i.e., chlorosis, etc.).
5. Date of silking (also plant height at silking).
6. Date of maturity.
7. Ear length or size.
8. Plant population.
9. Grain moisture at harvest.

Detailed data are desirable, but not necessary. Observations should be made relative to the treatments applied. For example, the farmer might note the difference in emergence between conventional and zero tilled plots in a tillage comparison test.

Yield

Yield estimates are the only means of making total production and economic comparisons between treatments. To be valid, take them from comparable areas in each plot to avoid unequal effects of soil variability, topography, trees, and other factors that may exist between the treatment areas, as described earlier. However, several soil conditions may be included, provided they occur to the same extent in

each treatment (see *Figure 1* for example). Yields should be determined by machine harvesting the middle rows from each treatment plot and measured in a weigh wagon or on a farm scale, provided the machine is completely clean before each treatment is harvested. If the entire plot area is harvested for yield, the plot areas should be as similar as possible. Determine the moisture content at harvest from a sample for each treatment. If machine harvesting is not possible, hand harvest 100 feet of two or more rows at two locations in each treatment. Again, make sure the harvested area covers similar soil conditions.

Data Sheets

Keep data sheets for all strip plot work, including as much of the above information as practical or possible. If the treatments are applied at more than one location, keep records for all locations. Differences in results between locations may be explained by the variability between location in weather, soils, planting conditions, pests, or any of the parameters previously discussed. Contact your extension agent or specialists for assistance in organizing data sheets.

Summary

The value of strip plots can be increased by following these simple guidelines. Increasing the number of locations within a geographic area will increase the usefulness of the data through more precise and reliable comparisons.

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